

Singapore Management University Institutional Knowledge at Singapore Management University

Research Collection School Of Information Systems

School of Information Systems

7-2016

From offline to online: How health insurance policies drive the demand for online healthcare service?


Yue YU

Qiu-Yan MEI

QIU-HONG WANG

Singapore Management University, qiu hong wang@smu.edu.sg

Follow this and additional works at: https://ink.library.smu.edu.sg/sis_research

 Part of the [Asian Studies Commons](#), [Computer Sciences Commons](#), [Insurance Commons](#), and the [Medicine and Health Sciences Commons](#)

Citation

YU, Yue; MEI, Qiu-Yan; and QIU-HONG WANG. From offline to online: How health insurance policies drive the demand for online healthcare service?. (2016). *PACIS 2016: Proceedings of the 20th Pacific Asia Conference on Information Systems, Chaiyi, Taiwan, June 27-July 1*. 1-13. Research Collection School Of Information Systems.

Available at: https://ink.library.smu.edu.sg/sis_research/3297

This Conference Proceeding Article is brought to you for free and open access by the School of Information Systems at Institutional Knowledge at Singapore Management University. It has been accepted for inclusion in Research Collection School Of Information Systems by an authorized administrator of Institutional Knowledge at Singapore Management University. For more information, please email libIR@smu.edu.sg.

Summer 6-27-2016

FROM OFFLINE TO ONLINE: HOW HEALTH INSURANCE POLICIES DRIVE THE DEMAND FOR ONLINE HEALTHCARE SERVICE?

Yue Yu

Huazhong University of Science and Technology, duqyuyue@qq.com

Meiqiu Yan

Huazhong University of Science and Technology, mei_qiuyan@qq.com

Qiu-Hong Wang

Singapore Management University, qiu hongwang@smu.edu.sg

Follow this and additional works at: <http://aisel.aisnet.org/pacis2016>

Recommended Citation

Yu, Yue; Yan, Meiqiu; and Wang, Qiu-Hong, "FROM OFFLINE TO ONLINE: HOW HEALTH INSURANCE POLICIES DRIVE THE DEMAND FOR ONLINE HEALTHCARE SERVICE?" (2016). *PACIS 2016 Proceedings*. Paper 387.
<http://aisel.aisnet.org/pacis2016/387>

This material is brought to you by the Pacific Asia Conference on Information Systems (PACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in PACIS 2016 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

FROM OFFLINE TO ONLINE: HOW HEALTH INSURANCE POLICIES DRIVE THE DEMAND FOR ONLINE HEALTHCARE SERVICE?

Yue Yu, School of Management, Huazhong University of Science and Technology,
China, duqyuyue@qq.com

Meiqiu Yan, School of Management, Huazhong University of Science and Technology,
China, mei_qiuyan@qq.com

Qiu-Hong Wang, School of Information Systems, Singapore Management University,
Singapore, qiu hong wang@smu.edu.sg

Abstract

Online healthcare service has gradually become a significant part of healthcare services, especially in emerging economy with shortage in medical resources and wide coverage in the Internet usage. This paper studies how health insurance policies affect the demand for online healthcare consultation by using longitudinal online healthcare and offline medical services datasets of a major city in China. The two policies we study are the integration of health insurance systems in urban and rural regions and the integration of health insurance systems between pairwise-cities. The empirical results show that both policies significantly affected the demand for online consultation. Our study is among the pioneering efforts examining the impact of health insurance policy on the demand for online healthcare services, in particular, the relocation of demand for medical services resulted from the integration of health insurance systems between rural and urban areas and across cities. It also provides an innovative angle to gauge the macro-level impact of medical insurance policy on the change and shift of medical service demand across channels and regions. This impact is difficult to detect in the past due to the disconnected hospital information systems and inconsistent medical insurance systems across hospitals and regions.

Keywords: Medical Insurance Policy, Online Healthcare Service, Medical Service

1 INTRODUCTION

Online healthcare service has gradually become a significant part of healthcare services, especially in emerging economy with shortage in medical resources and wide coverage in the Internet usage. For instance, China's online healthcare market is estimated to be worth \$2.7 billion in 2015¹ and Indian online healthcare product market is projected to grow at 46% during 2016-2020². The well-known Internet healthcare platforms in China such as haodf.com, guahao.com and xywy.com, etc., provide online healthcare services including appointment registration, physician-patient communication, and paid telephone consultation. As shown in Figure 1, the total monthly expense on telephone consultation between the registered patients and physicians through haodf.com presents a significantly increasing trend over the past five years, which evidences the tremendous growth in online healthcare markets. Online healthcare market arises as a complement of offline medical services. It is not constrained by geographic location and time. Thus patients can approach physicians in anywhere and physicians can respond to patients anytime (Zhou et al. 2007; Bergmo et al. 2005; Baker et al. 2005; Liederman et al. 2005). It also alleviates the information asymmetry problem pertaining to the healthcare markets. Online healthcare platform enables the information sharing and communication between patients and physicians. More and more patients turn to online healthcare platforms seeking information on disease and physicians to guide their offline medical needs. Furthermore, online healthcare platform facilitates the adaptive scheduling of offline medical services. Hence, patients may save a lot of waiting time by online booking the offline appointment. On the other hand, patients may switch from offline medical service to online healthcare service if their deceases are not critical or on physical treatment is needed. (T.S. Bergmo et al., 2005). Liederman et al. (2005) pointed that online consultation can partly substitute office clinic service in primary care practices and reduce medical expenses.

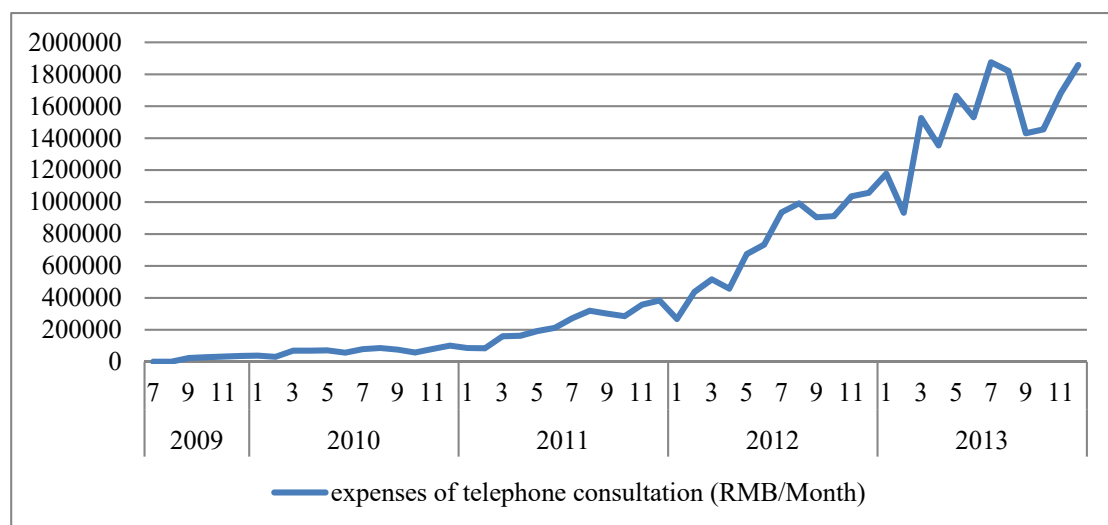


Figure 1.1 Expenses trend of telephone consultation on Haodf.com (RMB/Month)

¹ http://www.chinadaily.com.cn/business/2015-11/11/content_22428032.htm.
² http://www.researchandmarkets.com/research/zcqb8m/india_online.

Given the coexistence of complementary and substitutive roles of online healthcare services, the impact of any policy that intends to regulate offline medical service market should also be reflected to the change of online healthcare service. Thus the online healthcare service market may further serve as an indirect thermometer to gauge the potential impact of public policies on medical services across hospitals and regions in a macro level. In this study we choose a major city in China to investigate the possible impacts of medical insurance policies on the demand of online healthcare services. The public policies examined are the integration of health insurance systems between urban and rural regions implemented since October 1, 2010 and the integration of health insurance systems between pairwise cities implemented since January 1, 2012. By joining the hospital inpatient and outpatient data of the whole city and the online healthcare enquiries initiated by the local citizens and consultations provided by the local physicians, we are able to observe the changing amount of various online healthcare services demanded to local physicians and nonlocal physicians by local citizens.

We classify online healthcare service into four forms: free online consultation to local physicians; paid telephone consultation to local physicians; free online consultation to nonlocal physicians and paid telephone consultation to nonlocal physicians. We find that (1) the integration of health insurance systems between rural and urban regions is associated with the increasing number of free online consultation to local physicians and decreasing number of paid telephone consultation to nonlocal physicians; however, the effects on paid telephone consultation to local physicians and free online consultation services to nonlocal physicians are not significant. (2) The integration of health insurance systems between pairwise cities is associated with the decreasing number of free online consultation to local physicians, paid telephone consultation to local physicians and paid telephone consultation to nonlocal physicians, but increasing number of free online consultation services to nonlocal physicians. Our study may contribute to the literature and practices from two perspectives. First this is among the pioneering efforts examining the impact of health insurance policy on the demand for online healthcare services. Our finding is not trivial given the fast growth of online healthcare market and the underlying medical service demand that motivates online healthcare consultation. Next, this study provides an innovative angle to gauge the macro-level impact of medical insurance policy on the change and shift of medical service demand across channels and regions. This impact is difficult to detect in the past due to the private hospital information systems and inconsistent medical insurance systems across regions.

Our paper is organized in the following manner: Section 2 gives the literature review in this field. Section 3 explains the theoretical lens of this study. Section 4 elaborates on the research approach and data collection methods. In section 5, we provide our data analysis procedures and discuss our findings. Finally, we provide a summary of our findings and present some theoretical and practical implications.

2 RELATED LITERATURE

This study is related to three streams of research. The first stream is the adoption of electronic communication. The second stream examines the impact of online channel on offline healthcare service. The last stream studies the impact of health insurance policy on the

demand of traditional healthcare.

2.1 Adoption of Electronic Communication

Several researchers have investigated the demand and attitude of patients and physicians on online healthcare services. They found that patients had positive attitudes towards online healthcare and electronic healthcare record, while physicians hold a neutral attitude towards online communication with patients, and they prefer to choose telephone consultation (Harris et al. 2004; AF Kittler, GL Carlson, C Harris et al 2004). Harris et al. (2004) observed that 71% physicians thought online communication platform was beneficial to their offline clinic productivity and 84 percent of physicians thought that online communication platform was beneficial to their refill and referral request management and appointment scheduling. And 67 percent of physicians were willing to add online healthcare services if they could have enough financial incentives. Andrea Hassol et al. (2004) have researched 1421 users of EHR (Electronic Healthcare Record) and found that only a minority of users was concerned about the confidentiality of their information or about seeing abnormal test results after receiving only an explanatory electronic message from their provider. Patients preferred e-mail communication for some interactions, whereas they preferred in-person communication with others. Communication by telephone or writing was never their preferred choice. In contrast, physicians were more likely to prefer telephone communication and less likely to prefer e-mail communication. Although Harris and Hassol applied different way to conduct the experiment, they both researched the attitudes on online healthcare service of patients and physicians. And they both draw a conclusion that physicians are less preferred to choose online healthcare service than patients. Furthermore, Hassol found that telephone communication comparatively draw more physicians' attention than e-mail communication.

2.2 Impact of Online Healthcare on Traditional Healthcare

Some scholars have investigated the impact of online healthcare on patients' spending and physicians' productivity (Zhou et al. 2007; Bergmo et al. 2005; Baker et al. 2005; Liederman et al. 2005). T.S. Bergmo et al. (2005) recruited two hundred patients and divided them into two groups randomly. Comparing the number of online consultation, telephone consultation and primary care in one year each before and after this experiment, he found that online consultation substituted for part of primary care rather than telephone consultation. He thought it was because patients whose situations were under control preferred to choose online consultation instead of complicated physical examination. Liederman et al. (2005) and Baker et al. (2005) have reported that online consultation can partly substitute office clinic service in primary care practices and reduce medical expenses. And they also thought online healthcare service might improve patient satisfaction. Extensive research has been conducted to understand and explain the impact of online healthcare service on offline healthcare service, however, the prior results represented comprehensive effects including online to offline and offline to online. In order to fill in the blank, we used a variable which is exogenous to online healthcare service to study how the offline healthcare service affected online healthcare service.

2.3 Health Insurance Policy Research

Health insurance policy decides the cost of medical treatment. In western developed countries, the health insurance system exists in three typical forms: one is national healthcare system in England and Sweden; another is the social insurance system in Germany and France; the last is the multivariate unorganized health insurance system in countries such as the United States. In the process of health insurance system reform in China, policy makers have established a multi-level insurance system which takes basic health insurance system as corpus and other health insurance systems like commercial medical insurance as supplements. However, due to cultural and historical issues, the commercial medical insurance markets in China are underdeveloped and most of the farmers in rural areas were not covered by the national health insurance system. Even in urban areas, the health insurance policies under the same national framework differ with each other with aspects to health insurance coverage, reimbursements rate and the upper bounds, etc. In a report by Jeffrey et. al. (2012) Clemens, they found that higher reimbursements result in significant increase in traditional health care supply. However, incremental care has no significant impacts on the physical condition of patients. Seungchul Lee (2013) noted that prospective payment policy promotes the public hospitals and private hospitals in R&D cost saving technology and improves the efficiency of treatment. And Yi-Wen et al. (2005) drew a similar conclusion through the study of Taiwan health insurance payment policy. Most of these studies discussed how the policies influenced offline healthcare service. In this study, we use health insurance policy as an exogenous variable to clarify the influence mechanism of offline healthcare service on online healthcare service. Health insurance policy can influence offline healthcare behavior of patients but has no direct relationship with online healthcare behavior of patients. Therefore, after the implementation of the policy, any change in online healthcare service is a result of the underlying change in offline healthcare services.

3 THEORETICAL FRAMEWORK

With the assumption of rational patients, they will seek for high quality healthcare services with lower cost and better treatment effect. Let U_p denotes the utility of a local patient p , the utility function can be expressed as the following formula,

$$U_p = E_p - C_{poff} - C_{pon} \quad (3-1)$$

E_p denotes the treatment benefit received by a local patient, and C_{poff} denotes a local patient's offline healthcare cost and C_{pon} denotes his/her online healthcare cost. Since October 1, 2010, our studied city in China, W, has implemented the integration of health insurance systems in urban and rural areas. This reform grants rural residents the same reimbursement level as urban residents under the health insurance coverage. Therefore, it enlarges the healthcare insurance coverage, and expands the local healthcare services market. It is worth noting that the reform of health insurance system is independent with online consultation. Thus in our study we are able to capture the pure offline to online effect caused by the integration policy. Given the same treatment effect with urban patients, rural patients will choose either or both of the offline and online channels to maximize his/her

utility (U_p). Therefore, from healthcare cost perspective, local rural patients, now covered by an integrated health insurance policy tend to reduce the number of paid online healthcare services to save monetary cost and reduce the number of free online healthcare services to save time cost (they might have approached these two online services in the past when they were not able to access the medical resources covered by health insurance policy).

On the other hand, communication with physicians can possibly improve treatment benefit (E_p). Therefore, local patients may contact with physicians through the online platform in advance of visiting them. Thus, it is also reasonable for local patients to increase local free online consultation to serve the screening or trial purpose for the subsequent offline visiting.

Because of the coexistence of complementary and substitutive roles of local online free healthcare consultation related to offline medical services, whether the urban and rural medicare integration policy increases or decreases the number of online local free consultation is an empirical question. However, we can project that the number of local paid telephone consultation will decrease with the implementation of the integration policy.

In the nonlocal health care market, the number of nonlocal free online consultation and nonlocal paid telephone consultation will both decrease because the extensive and accessible local health care services attract the local patients who would otherwise have turned to nonlocal health care treatment. Following the above analysis we propose hypothesis 1:

H1: Urban and rural medicare integration policy will decrease the number of local and nonlocal paid online telephone consultation, and decrease the number of nonlocal online health care.

Similarly, the integration of health insurance systems between different cities enables patients to access high quality medical services in other cities. This may increase (decrease) the number of nonlocal online free healthcare consultation (the number of local free and paid, and nonlocal free and paid consultation services) which complements (substitutes) the offline visits to nonlocal physicians. Again, because of the coexistence of complementary and substitutive roles of nonlocal free online healthcare consultation related to offline medical services, whether the implementation of nonlocal reimbursement policy increases or decreases the number of online local free consultation is an empirical question. But we can project that the number of nonlocal paid telephone consultation will decrease.

H2: The implementation of nonlocal reimbursement policy will decrease the number of local online (both free and paid) healthcare consultation, and decrease the number of nonlocal paid telephone consultation.

4 RESEARCH SETTING AND DATA

We collected the offline hospital data from the Hospital Information System (HIS) of city W. and the online healthcare service data from the online third-party platform during the period from January 2009 through December 2013.

4.1 Hospital Service Data

The offline hospital data provides detailed information about all physicians' outpatient and inpatient services in each medical institute of the city over 1096 days from January 2010 to May 2013. We counted the number of outpatient and inpatient by day to measure the aggregate volume of offline medical services. As we should notice, this data is unavailable for the whole year of 2009.

4.2 Online Service Data

Our online service data were collected from haodf.com, the largest online healthcare service platform hosted by a third party. In Haodf.com, the registration is open to physicians and patients all over the country. After registration and identity authentication, a personal sub-portal is assigned to a physician, where he/she can activate free consultation service, paid telephone service, and online appointment to the public, publish articles and launch his/her own patients sub-forums. At present, more than 70,000 physicians from thirty-one provinces are active on Haodf.com. Among the various services available in Haodf.com. Online consultation is the most popular one through which patients can directly send enquiries to their preferred physicians and the physicians can decide which questions to answer. Whereas, it is not free to book telephone consultation with preferred physicians. The service charge ranges from around USD 15-60 per 15 minutes. Obviously it provides more timely and effective communication with physicians compared to the free online consultation. In our study, we collected all the online healthcare activities over 1826 days from 2009 to 2013, including the number of local and nonlocal free online consultation from local patients per day, the number of local and nonlocal paid telephone consultation from local patients per day. It is worth mentioning that we use keyword extraction technology to distinguish local patients from nonlocal patients. And the accuracy of our classification result is 87%. Table 1 is the summary statistics of our time series data.

Variables	description	Obs.	Mean	SD	Min	Max
isUnion	Dummy variable	1826	0.65	0.47	0	1
isOthercov	Dummy variable	1826	0.40	0.49	0	1
Online consultation in nonlocal cities	Times by day	1826	13.84	9.82	0	53
Online consultation in local city	Times by day	1826	2.84	4.54	0	112
Telephones in nonlocal cities	Times by day	1826	0.94	1.63	0	11
Telephones in local city	Times by day	1826	0.013	0.12	0	2

Physicians' websites in local city	Times by day	1826	0.13	0.41	0	5
Physicians' websites in nonlocal city N	Times by day	1826	0.96	1.47	0	19
Physicians' websites in nonlocal city S	Times by day	1826	2.72	3.34	0	31
Physicians' websites in nonlocal city B	Times by day	1826	4.15	3.69	0	48
Online consultation in major cities	Times by day	1826	2383.10	1313.22	54	5734
Outpatients in local hospitals	Times by day	1096	9620.74	2949.14	10	15538
Inpatients in local hospitals	Times by day	1096	432.18	173.69	1	986

Table1 *Summary statistics of main variable*

5 ANALYSIS AND RESULT

5.1 Impact of Urban and Rural Medicare Integration Policy on Online Healthcare

In order to estimate the impact of urban and rural medicare integration policy on the demand of t online healthcare services, we use time series datasets, and control for the time trend and the development of Haodf.com.

Considering that the implementation date of urban and rural medicare integration policy is January 1, 2011, we can use the time series datasets over 1,096 days between the beginning of 2009 and the end of 2012.

Model 1

$$\begin{aligned}
 Consultation_t = & \alpha \times isUnion + \beta \times time_n + \sum \gamma_i \times year_{it} \\
 & + \sum \delta_j \times \\
 & openWebsite_{jt} + \varepsilon + \mu_t
 \end{aligned} \tag{5-1}$$

Let $Consultation_t$ denotes the number of online healthcare services and $isUnion$ indicates the status of the integration policy which is set 0 without enacting the policy and equals to 1 if it has been enacted. $time_n$ is aim to control for the time trend over days. Meanwhile, we use $time_n$ to represent the development of the website. $year_{it}$ as a dummy variable aim to control for the time trend over years. Let $openWebsite_{jt}$ denotes the number of physicians who registered personal-website in haodf.com. ε is the constant term, and μ_t is the error term. Therefore, α represents the impact of urban and rural medicare integration policy on the number of online health care services. In the first model, we conduct four regressions in which in the dependent variables are the number of local free online consultation, the number of local paid telephone consultation, the number of nonlocal paid online consultation and the number of nonlocal paid telephone consultation respectively. Through the autocorrelation test and partial autocorrelation tests, we find the sequence of time series datasets have six-order autocorrelation. Therefore, we use regression with Newey-West standard errors adding six lags to the formula until the error term is white noise. Table 2 reports the results.

Variables	Online consultation in local city	Telephones in local city	Online consultation in nonlocal cities	Telephones in nonlocal cities
isUnion	7.997***	-0.005	-0.307	-0.326***
	(1.344)	(0.004)	(1.057)	(0.073)
time	0.001	2.64e-05	0.009**	0.002***
	(0.002)	(2.28e-05)	(0.004)	(0.0003)
2010.year	-0.828	-0.00805	5.487***	-0.486***
	(1.032)	(0.007)	(1.499)	(0.103)
2011.year	-5.250***	-0.011	10.550***	-0.671***
	(1.913)	(0.013)	(2.872)	(0.176)
2012.year	-8.549***	-0.0130	7.548*	-0.346
	(2.497)	(0.016)	(3.917)	(0.297)
Physicians' websites in local city(openWebsite ₁)	0.015	-0.003*	0.890**	0.006
	(0.254)	(0.001)	(0.414)	(0.062)
Physicians' websites in nonlocal city N (openWebsite ₂)	-0.048	-0.0004	0.185*	0.007
	(0.064)	(0.0005)	(0.108)	(0.011)
Physicians' websites in nonlocal city S (openWebsite ₃)	-0.050*	-0.0006	0.072	0.009
	(0.028)	(0.0005)	(0.063)	(0.008)
Physicians' websites in nonlocal city B (openWebsite ₄)	0.024	0.001*	0.104	0.018
	(0.033)	(0.0008)	(0.078)	(0.013)
Constant	1.512***	-0.008	1.756*	-0.474***
	(0.375)	(0.0062)	(1.046)	(0.090)
Observations	1,096	1,096	1,096	1,096

Table 2 *Impact of urban and rural medicare integration policy on online health care*

We find that the implementation of urban and rural medicare integration policy increases in average the volume of local free online consultation from local patients by 281% (8.00 divided by the average value 2.84) per day and decreases the volume of nonlocal paid telephone consultation from local patients by 34.0%(0.32 divided by 0.94) per day. The impacts on local paid telephone consultation and nonlocal free online consultation services are insignificant. The estimation shows that that the impact of offline healthcare service on local free online consultation is positive. And it gives the quantitative complementary effects.

5.2 Impact of Nonlocal Reimbursement Policy on Online Healthcare

In order to estimate the impact of nonlocal reimbursement policy on the demand of the

number of online health care services, we use time series datasets, and control for the time trend and the development of Haodf.com.

Considering that the implementation time of nonlocal reimbursement policy is January 1, 2012, we can use the time series datasets over 1096 days between the beginning of 2011 and the end of 2013.

Model 2

$$\begin{aligned} Consultation_t = & \alpha \times isOthercov + \beta \times time_t + \sum \delta_j \times openWebsite_{jt} + \rho \times \\ & outpatient_t + \sigma \times \\ & inpatient_t + \varepsilon + \mu_t \end{aligned} \quad (4)$$

Let $Consultation_t$ denotes the number of online health care services. This city implemented nonlocal reimbursement policy when $isOthercov$ as a dummy variable is equal to 1, and year as a dummy variable control for the trend of year, $openWebsite_{jt}$ denotes the number of physicians from local and nonlocal cities who registered self-website in Haodf.com. Let $outpatient_t$ denotes the number of outpatient from all hospitals in the local city, and $inpatient_t$ denotes the number of outpatient from all hospitals in the local city. ε is the constant term, and μ_t is the error term. Therefore, α represents the impact of nonlocal reimbursement policy on the number of online health care services. Then we conduct four similar regressions. Table 3 reports the results.

Variables	Online consultation in local city	Telephones in local city	Online consultation in nonlocal cities	Telephones in nonlocal cities
isOthercov	-2.253***	-0.029*	6.043***	0.586***
	(0.489)	(0.0138)	(2.124)	(0.184)
time	-0.003***	0.0001***	-0.023***	0.004***
	(0.0007)	(3.03e-05)	(0.003)	(0.0003)
Physicians' websites in local city(openWebsite ₁)	0.060	-0.007	1.154**	0.087
	(0.254)	(0.007)	(0.516)	(0.101)
Physicians' websites in nonlocal city N (openWebsite ₂)	-0.092	0.002	0.150	-0.002
	(0.073)	(0.004)	(0.152)	(0.024)
Physicians' websites in nonlocal city S (openWebsite ₃)	-0.027	0.001	0.466***	0.052**
	(0.034)	(0.002)	(0.123)	(0.024)
Physicians' websites in nonlocal city B (openWebsite ₄)	0.036	0.001	0.117	0.031*
	(0.025)	(0.002)	(0.084)	(0.018)
Outpatient	0.0002**	1.94e-06	8.27e-06	6.78e-05**

	(6.88e-05)	(2.91e-06)	(0.0004)	(3.42e-05)
Inpatient	-0.001	-1.16e-05	0.004	-0.0007
	(0.001)	(4.77e-05)	(0.007)	(0.0007)
Constant	7.000***	-0.115***	38.870***	-4.003***
	(0.789)	(0.037)	(3.997)	(0.334)
Observations	1,096	1,096	1,096	1,096

Table 3 *Impact of nonlocal reimbursement policy on online health care*

In addition to these regressions, we consider that the outpatient and inpatient services may lag behind online health care services. So we also conduct regression with 6-day lag of outpatient and inpatient instead of prior factors. And we finally get the results consistent with the prior findings. We find that the implementation of nonlocal reimbursement policy decreases the volume of local free online consultation from local patients by 79%(2.25 times divided by 2.84) per day, decreases the volume of local paid telephone consultation from local patients by 220%(0.03 time divided by 0.013) per day, increases the volume of nonlocal free online consultation from local patients by 43.6%(6.04 times divided by 13.84) per day and decreases the volume of nonlocal paid telephone consultation from local patients by 62.8% (0.59 time divided by 0.94) per day. According to the results, we can infer that there exist the complementary effect of offline healthcare service on local free online healthcare service and the substitution effect of offline healthcare service on paid online healthcare service.

6 CONCLUSION

Adopting utility theory as the theoretical lens of this research, our findings explains how health insurance policy influences the demand for online healthcare consultation. The paper also compares the differences between the impact of the integration of health insurance systems in rural and urban regions and the integration of health insurance systems between pairwise cities. The former policy expands the demand for local medical services and the latter policy expands the demand for nonlocal medical services. Our empirical results suggest that the integration of health insurance systems in rural and urban regions had a positive effect on free online consultation to local physicians and the integration of health insurance systems between pairwise cities had a positive effect on free online consultation to nonlocal physicians. In the theoretical framework, we know that the demand for free online consultation service is driven by both the augmentation and substitution forces originated from intrinsic demand for medical services. Our estimation results show that the augmentation effect dominates the substitution effect. This finding highlights that the local patients usually prefer making online communication with physicians as a screening step before offline visiting which might improve clinic treatment quality. Therefore, in order to achieve the optimal allocation of medical resource, policy makers should encourage the online free consultation service playing a role to reduce the information asymmetry and matching suitable patients and physicians. On the other hand, the online paid telephone consultation service usually plays a role to substitute the offline medical services. Thus the policy maker should be aware of the potential risk and conflicting interest involved here.

The future direction of this study is to incorporate more cities into the analysis and conduct

nature experiment to further explore the impacts across cities with different timeline and implementation strategies. Furthermore, more insights may be derived by differentiating the impacts among medical specialties.

7 Acknowledge

We thank Xi Chen for his help in soliciting the offline hospital data. This research was supported by the National Science Foundation of China project 71371082. Corresponding author: Qiu-Hong Wang, qiu hong wang@smu.edu.sg.

Reference

- Hassol, A., Walker, J. M., Kidder, D., Rokita, K., Young, D., Pierdon. and Ortiz, E. (2004). Patient experiences and attitudes about access to a patient electronic health care record and linked web messaging. *Journal of the American Medical Informatics Association*, 11(6), 505-513.
- Kittler, A., Pizziferri, L., Volk, L., Jagannath, Y., Wald. and Bates, D. (2004). Primary care physician attitudes towards using a secure web-based portal designed to facilitate electronic communication with patients. *Journal of Innovation in Health Informatics*, 12(3), 129-138.
- Gottlieb, J. D. (2011). Do Physicians' Financial Incentives Affect Medical Treatment and Patient Health?.
- Yip, W. C. (1998). Physician response to Medicare fee reductions: changes in the volume of coronary artery bypass graft (CABG) surgeries in the Medicare and private sectors. *Journal of health economics*, 17(6), 675-699.
- Rice, T. H. (1983). The impact of changing Medicare reimbursement rates on physician-induced demand. *Medical care*, 21(8), 803-815.
- Godager, G. and Wiesen, D. (2013). Profit or patients' health benefit? Exploring the heterogeneity in physician altruism. *Journal of health economics*, 32(6), 1105-1116.
- Kumar, A. and Telang, R. (2012). Does the web reduce customer service cost? Empirical evidence from a call center. *Information Systems Research*, 23(3-part-1), 721-737.
- Brennan, T. A., Leape, L. L., Laird, N. M., Hebert, L., Localio, A. R., Lawthers, A. G. and Hiatt, H. H. (1991). Incidence of adverse events and negligence in hospitalized patients: results of the Harvard Medical Practice Study I. *New England journal of medicine*, 324(6), 370-376.
- Jena, A. B., Seabury, S., Lakdawalla, D. and Chandra, A. (2011). Malpractice risk according to physician specialty. *New England Journal of Medicine*, 365(7), 629-636.
- Bates, D. W., Kuperman, G. J., Wang, S., Gandhi, T., Kittler, A., Volk, L. and Middleton, B. (2003). Ten commandments for effective clinical decision support: making the practice of evidence-based medicine a reality. *Journal of the American Medical Informatics Association*, 10(6), 523-530.
- Afendulis, C. C. and Kessler, D. P. (2006). Tradeoffs from integrating diagnosis and treatment in markets for health care (No. w12623). National Bureau of Economic Research.

- Albert Ma, C. T. and Riordan, M. H. (2002). Health insurance, moral hazard, and managed care. *Journal of Economics & Management Strategy*, 11(1), 81-107.
- Bergmo, T. S., Kummervold, P. E., Gammon, D. and Dahl, L. B. (2005). Electronic patient-provider communication: Will it offset office visits and telephone consultations in primary care?. *International journal of medical informatics*, 74(9), 705-710.
- Dharmar, M., Sadorra, C. K., Leigh, P., Yang, N. H., Nesbitt, T. S. and Marcin, J. P. (2013). The financial impact of a pediatric telemedicine program: a children's hospital's perspective. *TELEMEDICINE and e-HEALTH*, 19(7), 502-508.
- Liederman, E. M., Lee, J. C., Baquero, V. H. and Seites, P. G. (2005). The impact of patient-physician Web messaging on provider productivity. *J Healthc Inf Manag*, 19(2), 1-6.